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Docket No.: 49959-039

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of : **RESPONSE UNDER 37 CFR 1.116**
: **EXPEDITED PROCEDURE**
: Customer Number: 20277
Ariel BEN-PORATH :
: Confirmation Number: 4880
Serial No.: 09/334,049 :
: Group Art Unit: 2623
Filed: June 15, 1999 :
: Examiner: Vikkram Ball
:
For: HYBRID INVARIANT ADAPTIVE AUTOMATIC DEFECT CLASSIFICATION

RESPONSE

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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JUL 29 2004
Technology Center 2600

Sir:

The following remarks are submitted in response to the Final Office Action dated May 24, 2004.

Claims 1-5 and 7-30 are pending in the application.

In the Office Action, claims 1 and 3-5 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent 6,047,083 (Mizuno). Claim 2 was rejected under 35 U.S.C. §103(a) as being unpatentable over Mizuno in view of the article entitled "Automatic defect classificationn for semiconductor manufacturing", by Paul B. Chou et al, Machine Vision and Application, 1997, pp. 201-213 (Chou). Claim 6 was rejected under 35 U.S.C. §103(a) as being unpatentable over Mizuno in view of the discussion at page 11, lines 7-30 of the present application. Claims 7-9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Mizuno in view of U.S. Patent

5,172,421 (Nakamura). Claims 10-18 and 22-30 were rejected as claims 1-9, because they are claiming similar subject matter as claims 1-9. Claims 19, 20 and 21 were rejected as claims 1, 8 and 9, because they are claiming similar subject matter as claims 19, 20 and 21. These rejections are respectfully traversed. Applicant respectfully requests reconsideration and allowance of the claims in view of the following arguments.

The present invention and the cited references were discussed in detail in Applicant's Amendment of August 13, 2002. For convenience, Applicant refers the Examiner to that discussion.

The present invention utilizes the best attributes of three different types of classifiers to perform defect classification more quickly and reliably than prior art methodologies. It employs a rule-based core classifier for fast initial classification of defects into a predetermined number of core classes, the core classifier being able to work during start-up and ramp-up of a production line because it does not require examples of defects. It also uses non rule-based specific adaptive classifiers (i.e., "classic classifiers"), each associated with only a small number of the core classes (e.g., with only one or two core classes), trained by the user with sample defect images, in parallel with the core classifier for sub-classification within a core class. The present invention further employs a full classifier (also based on sample defect images), but only on a limited basis for special types of defects that do not fit in to the core classification scheme. Thus, as the fabrication process matures and the types of defects of interest become more diverse, the specific adaptive and full classifiers can be trained as needed to perform more detailed defect classification.

None of the cited prior art references, alone or in combination, teaches or suggests an apparatus or a method that employs both a rule-based core classifier and a specific adaptive

classifier associated with only a small number of the core classes that is a classic classifier trained by the user with a set of sample defect images, as required by independent claims 1, 10, 19 and 22.

Regarding the obviousness rejection of independent claims 1, 10, 19 and 22 based on Mizuno, the primary Mizuno reference teaches the use of a rule-based core classifier to classify defects into one of a predetermined number of core classes. However, as admitted in the Office Action, Mizuno fails to teach or suggest using a specific adaptive classifier associated with the one core class and less than the predetermined number of core classes, and trained by the user with a set of sample defect images, to further classify the defect into a subclass, as required by independent claims 1, 10, 19 and 22. Rather, Mizuno teaches using a second core classifier, based on the design rules of the device, for this function. In other words, Mizuno uses a rule-based classifier to initially classify defects, and also to subclassify the defects.

However, it is contended in the Office Action that it would have been obvious to modify Mizuno's technique to add the claimed specific adaptive classifier to yield the claimed invention. This contention is supposedly supported by the fact that Mizuno teaches, at col. 5:15-20, subclassification of defects using a pattern design rule of the device which is stored by Mizuno's apparatus. The Office Action, at page 4, considers this to be the claimed classic classifier trained by the user, because the design rules are "recorded in to the apparatus prior to the inspection, i.e., in the training phase and that is done by the user interface, i.e., the user's involvement in training the classifier".

Applicant disagrees. The user's implementation of the design rules of a device under inspection would not be considered "training" of the classifier by a skilled artisan, under the plain meaning of the word "training" as used in the present application and in the cited prior art.

Applicant submits that such an interpretation of the word “training” is unreasonably broad and has no support in the art.

Even assuming, *arguendo*, that the user’s involvement in setting up Mizuno’s apparatus was considered to be training by the user (as contended in the Office Action), Mizuno would nevertheless lack a teaching or suggestion of the *claimed* classic classifier, because it would not comprise a classifier trained by the user *with a set of sample defect images*, as required by the independent claims. Mizuno’s classifier described at col. 5 is the epitome of a rule-based classifier, in that it classifies based on the design rules of the inspected semiconductor device. It needs no sample defect images to classify, since it uses the device’s design rules.

It is pointed out in the Office Action that the claims must be given their broadest reasonable interpretation during examination. However, it is also required that all words in a claim be considered in assessing patentability. *In re Wilson*, 424 F.2d 1382, 1385 (CCPA 1970). In other words, the Examiner cannot ignore claim language. It seems that in the latest Office Action, the limitation of independent claims 1, 10, 19 and 22 that the specific adaptive classifier is trained by the user *with a set of sample defect images* has been disregarded. This is not proper, since to establish *prima facie* obviousness of a claimed invention under 35 U.S.C. §103, all claim limitations must be taught or suggested by the cited prior art. *In re Royka*, 490 F.2d 981 (CCPA 1974).

Since Mizuno does not teach or even suggest the claimed classic-style specific adaptive classifier associated with less than a predetermined number of core classes of defects and trained by the user with a set of sample defect images, it would not have been obvious to modify Mizuno combination to yield the invention of claims 1, 10, 19 or 22. In fact, insofar as it teaches the use of

the design rules of the inspected semiconductor device to subclassify defects, Mizuno *teaches away* from the claimed specific adaptive classifier.

Thus, it would not have been obvious to modify Mizuno to yield the inventions of independent claims 1, 10, 19, and 22, because Mizuno does not teach or suggest the step of classifying a defect as being in one of an arbitrary number of variant subclasses using a specific adaptive classifier associated with less than a predetermined number of core classes that is a classic classifier trained by the user with a set of sample defect images, as required by independent claims 1 and 22; and does not disclose or suggest a specific adaptive classifier associated with less than a predetermined number of core classes for classifying the defect as being in one of an arbitrary number of variant subclasses that is a classic classifier trained by the user with a set of sample defect images, as required by independent claims 10 and 19.

Consequently, claims 1, 10, 19 and 22 are patentable, as are claims 3-5, 12-14, 23-26, and 30, which depend from claims 1, 10, 19 and 22, respectively.

Regarding the obviousness rejection of claims 2 and 11 based on Mizuno and Chou, the Chou reference does not teach or suggest the claimed classic-style specific adaptive classifier, associated with less than a predetermined number of core classes of defects and trained by the user with a set of sample defect images, missing from Mizuno. Chou does not teach or suggest using non rule-based classifiers *associated with less than a predetermined number of core classes* to subclassify defects, as claimed. Chou does not mention subclassification. Therefore, any combination of Mizuno and Chou, however made, would still be missing the claimed specific adaptive classifier, and it would not have been obvious to add the claimed specific adaptive classifier to any Mizuno/Chou combination.

Consequently, claims 2 and 11 are patentable.

Regarding the obviousness rejection of claims 6 and 15 based on Mizuno and page 11, lines 7-30 of the application, it is contended in the Office Action that the Applicant admits (at page 11, lines 7-30) that a plurality of specific adaptive classifiers as claimed in claims 6 and 15, each associated with less than a predetermined number of core classes, is in the prior art. This is not correct. There is no support at page 11 or anywhere else in the specification for the contention that Applicant considers the claimed plurality of specific adaptive classifiers to be in the prior art. In fact, the application is replete with statements as to the inventiveness of the claimed specific adaptive classifiers. See, for example, page 7, lines 28 et seq., distinguishing specific adaptive classifiers from prior art classic classifiers.

Since all the limitations of claims 6 and 15 are not found in the cited references, the rejection under § 103 should be withdrawn. Consequently, claims 6 and 15 are patentable.

Regarding the obviousness rejection of claims 7-9, 16-18, 20-21 and 27-29 based on the Mizuno and Nakamura references, Nakamura does not teach or suggest the recited specific adaptive classifier of independent claims 1, 10, 19 and 22 (from which claims 7-9, 16-18, 20-21 and 27-29 depend) missing from Mizuno. Nakamura teaches a rule-based classifier (see Nakamura, Abstract). Moreover, Nakamura does not teach a classifier associated with a particular core class, as claimed. Still further, Nakamura does not teach the claimed combination of a core classifier and a specific adaptive classifier associated with a particular core class. Therefore, any combination of Mizuno and Nakamura, however made, would still be missing the claimed specific adaptive classifier, and it would not have been obvious to add the claimed specific adaptive classifier to any Mizuno/Nakamura combination.

Consequently, claims 7-9, 16-18, 20-21 and 27-29 are patentable.

Reconsideration and withdrawal of the rejection of claims 1-30 under 35 U.S.C. §103 are respectfully requested.

Accordingly, it is believed that all pending claims are now in condition for allowance. Applicant therefore respectfully requests an early and favorable reconsideration and allowance of this application. If there are any outstanding issues which might be resolved by an interview or an Examiner's amendment, the Examiner is invited to call Applicant's representative at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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